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Solar electricity

THE WORLD Energy Council projects that by 2050, electrical energy needs will double, which will give rise to a staggering energy shortage. This deficit cannot be made up by fossil fuels because of the dwindling rate of reserve of the latter. The environmental pollution caused by their combustion has caused public concern.

At present, the global energy mix comprises mainly the following sources: wood and biomass, coal, hydro, oil, gas and nuclear. Renewable energy forms have engaged the attention of a wide range of entrepreneurs, from penniless to wealthy. One such form is the energy that is freely available from sunlight, which can be converted into electric power by photo-voltaic cells.

Charles Fritt invented in 1885 the selenium-based cell which has triggered the curiosity of workers from amateurs to professional scientists. The conversion efficiency did not exceed one percent, still the early pioneers continued their pursuit with optimism and imagination.

Solar cells functioned very poorly for several years till 1954, when the Bell Laboratories came up with the invention of the p-n junction, a silicon-based semi-conductor device. This raised the efficiency to the level of about 6 per cent.

But the light harvesting material of the former had to be 99.90 per cent pure and crystalline, which made it very expensive, namely several hundred dollars per watt of electric power produced. The commercial exploitation of solar cells had to wait for the advent of the space age. It was the need to power satellites that gave the breakthrough: the price of solar cells dropped to \$ 20 per watt, by which they became competitive with primary batteries. With gallium arsenide cells which has an efficiency of 10 per cent, the

cost has further come down to \$ 5 per watt.

We now see its triumphant entry into the consumer trade: a wide range of cooking ranges electric and water heating systems for household electric power supply right at the traffic control junction, etc.

Father Bernard Vesperin, a Jesuit Priest, pressed it into humanitarian service by installing solar-driven pump sets in Mali. Tapping into Sun's huge energy reservoir is a great challenge. The supply of energy from the Sun is estimated at 3×10^{24} joules per year, which is 10,000 times more than the world's present consumption. Employing integrated installations with solar cells of 10 per cent efficiency, this would cover 0.1 per cent of the Earth's surface satisfying the world's current needs.

Novel concepts which differ from the operating principle of p-n junctions for converting solar light into energy are under study for effecting significant cost reduction. One such is the application of molecular photo voltaics.

“These systems operate like the natural photosynthesis, mimicking a process that has worked well for the past 3.5 billion years, providing all the world's fossil energy reserves.

The use of artificial photo synthesis for converting (directly into electricity) and storing solar energy provides exciting prospects for the new millennium".(Source: Nature - January 27)

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